

Final Report  
Nevada NASA EPSCoR Bridge Grant  
February 25, 1997

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## Overview

As the result of promising reviews on an earlier NASA EPSCoR proposal evaluation, the University of Nevada was granted funds to bridge between current work in preparing for the next round of proposals. This work was to focus on a two clusters: one in composite materials centered in engineering and another in astrophysics in physics.

Work was directed at developing laboratories, one for manufacturing light weight materials and another for accomplishing high performance computations. In addition, an effort was to be mounted to continue to make contacts with NASA Centers and allied organizations to increase their involvement in the work.

All goals of the work were accomplished. Facilities were developed, and many contacts were made. However, when the next round of proposals came up, the proposal for Nevada was not funded. Brief details about the work accomplished during the Bridge Grant are summarized in what follows.

## Composites Manufacturing Cluster

The goal of the composites manufacturing cluster was to develop a research effort in the area of thermoplastic pultrusion. An experimental pultrusion facility was designed and fabricated for performing controlled manufacturing experiments. The pull speed, preheater temperature, heated die temperature, and cooled die temperature are all computer controlled and the data acquisition system can record up to 16 channels of temperature, die pressure, velocity, or pull force data. Experimental work is aimed at optimizing the die geometries and process variables to enable commercially viable production rates. Additional work involves experimenting with different material preforms for process optimization.

The die geometry is a critical element for successful thermoplastic pultrusion. Research was also conducted to simulate the processing environment inside the heated pultrusion die. Customized compression molding equipment was also designed and fabricated for this effort.

One graduate student was supported by the project directly with salary and research expenses, and the grant also supported the research expenses for a second graduate student. The project also supported 6 different undergraduate students for summer research projects and part-time work during the semester. Funds from the NASA Space Grant and the NSF REU were also used to support students on this project.

Industrial contacts were made with over a dozen manufacturing companies, federal agencies including NASA LaRC, and material suppliers. We are still collaborating with several of these contacts about ongoing research efforts in this area. We received a large material donation of commingled IM7/PEEK for use on this project from Cytac industries valued around \$40,000.

Results of research have been published in 2 papers and 2 more are still in the works. We recently were contacted by an aerospace company about doing some development research on pultruded thermoplastic composite fasteners. A contract has been let for this work. Overall, the objectives of the original bridging grant proposal were clearly met.

## Astrophysics Cluster

The funds for the Astrophysics cluster were used to support the stated goals of the submitted proposal.

Goal i) "the NASA EPSCoR grant will be used to nurture links with NASA programs and the greater academic community..."

Dr. Lepp visited Drs. Kallman and Dwek at the NASA Goddard Space Flight Center. The contacts helped us identify projects which are of interest to the space science effort at the NASA laboratories. In addition he has started investigating collaborations with NASA supported labs at JPL.

Funds were used to support visits to the NASA Goddard Space Flight Center by Prof. B. Zygelman who gave a Laboratory for Astronomy and Solar Physics Seminar Series talk "Calculation of Atomic and Molecular Data, for Application in Astrophysics, on a Distributed Cluster" on Sept. 14 1995. Funds were also used to support a trip by Dr. P.C. Stancil, a postdoctoral fellow of Dr. Zygelman, to NASA Goddard.

Dr. Zygelman used NASA funds to support collaborative research at the Harvard-Smithsonian Center for Astrophysics. Dr. Zygelman gave a CfA-AMP Division Seminar talk at the CfA in July 1996.

Goal ii) "We will recruit personnel in the field of atomic and molecular astrophysics, and upgrade the W. M. Keck Laboratory for Computational Physics at UNLV."

To this end a workstation was purchased, for use by Drs. Zygelman, Stancil, and Mr. J. Annoreno. Mr. Annoreno, a graduate student, was recruited by Dr. Zygelman and funded by the NASA Bridge Grant.

Another workstation was purchased, and it is used to calculate atomic and molecular data and models of astrophysical environments. The data and models are important for the interpretation of data gathered by NASA space missions. The workstation has been heavily used by the Lepp's group for models and calculations.

Several papers have been presented by Drs. Zygelman, Stancil and Mr. Annoreno at national meetings sponsored by the American Physical Society and the AAS. We have submitted a paper to the Physical Review, "Ab-initio Theory of Charge Capture in Collisions of  $N^{+4}$  and Hydrogen, which acknowledges the NASA support.

Dr. Lepp, and Stefano Tine' have presented papers at the AAS meeting and an IAU Symposium on Astrochemistry as well as smaller meetings.

Robert Vaughn graduated with a Ph.D. in Spring of 1996. Some of his work was done on the workstation purchased for this grant. He worked with Dr. Lepp and his thesis is on Models of the Interstellar Medium, in particular he was looking for bistable solutions in interstellar cloud models and how they are affected by parameters such as the abundance of grains or metals.

Stefano Tine' a postdoc working with Dr. Lepp has been conducting models of molecular hydrogen emission on the workstations purchased on this grant. He has also been working on the cooling of interstellar gas by molecular hydrogen which will be written up for publication later this year.